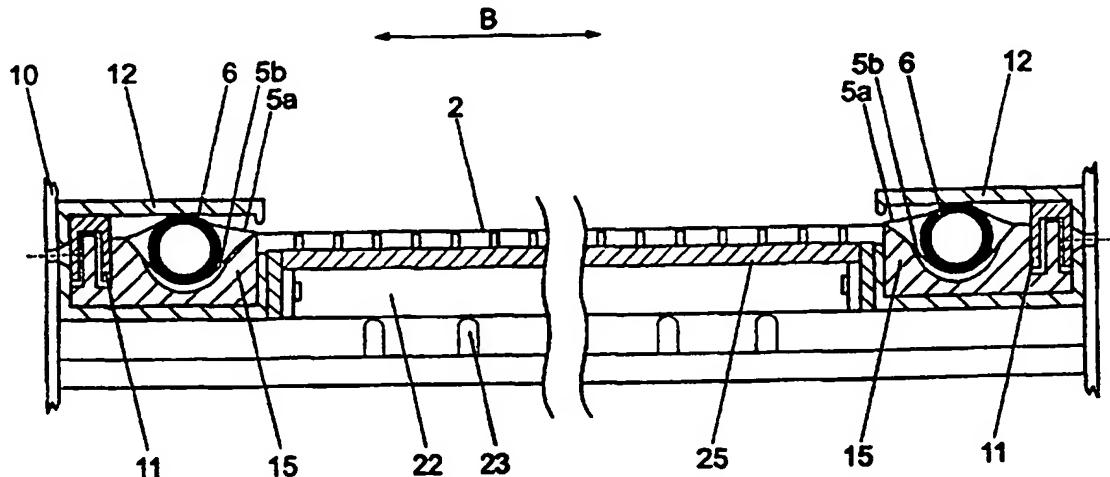




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<p>(21) International Application Number: PCT/GB97/01607</p> <p>(22) International Filing Date: 13 June 1997 (13.06.97)</p> <p>(30) Priority Data:</p> <table> <tr><td>9612372.4</td><td>13 June 1996 (13.06.96)</td><td>GB</td></tr> <tr><td>9613066.1</td><td>21 June 1996 (21.06.96)</td><td>GB</td></tr> <tr><td>9623831.6</td><td>16 November 1996 (16.11.96)</td><td>GB</td></tr> </table> <p>(71) Applicant (for all designated States except US): ITS HOLDINGS LIMITED [GB/GB]; 61 Woodside Road, New Malden, Surrey KT3 4AW (GB).</p> <p>(72) Inventor; and</p> <p>(75) Inventor/Applicant (for US only): WOODBURN, William [GB/GB]; 19 Parkgrove Avenue, Edinburgh EH4 7QJ (GB).</p> <p>(74) Agent: MURGITROYD & COMPANY; 373 Scotland Street, Glasgow G5 8QA (GB).</p>		9612372.4	13 June 1996 (13.06.96)	GB	9613066.1	21 June 1996 (21.06.96)	GB	9623831.6	16 November 1996 (16.11.96)	GB	<p>(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW. ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</p> <p>Published With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</p>	
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(54) Title: APPARATUS FOR ATTACHING FILTER MEANS TO A FRAME



(57) Abstract

Apparatus for clamping filter means to a frame, particularly for filtering particles from drilling fluid recovered from oil wells. The apparatus has means to clamp the filter to a frame, and tensioning means such as a hose which expands to press the filter or a portion thereof into a groove adapted to receive the hose.

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1 Apparatus for attaching filter means to a frame.

2

3 This invention relates to improvements to filter
4 screens, typically those used in the oil industry to
5 filter particles from drilling fluid.

6

7 It is generally known that woven screens of single,
8 double or triple meshes can be mounted within vibratory
9 units by means of fixing hooks and/or bolts to tension
10 the screens over cambered support frames. The frames
11 with the screen(s) attached thereto are located on
12 cradles disposed within a basket of the vibratory
13 apparatus. Also, single, double or triple meshes which
14 are pretensioned can be fixed to four-sided frames
15 which are attached, by any suitable means, within a
16 vibratory unit. In both instances the screens must be
17 slid into and out of the vibratory unit's basket. It
18 is essential to remove the screens periodically for
19 servicing and replacement, and the efficiency and
20 simplicity of the clamping and tensioning is important
21 in minimizing down times.

22

23 Frames formed of an inflatable material are also known
24 to clamp and apply tension to the screen. However,
25 this has the disadvantage that the tensioning and

1 clamping forces are often incompatible. The
2 incompatibility can be increased in screens of double,
3 or triple meshes and/or of differing mesh
4 specifications and/or material dimensions), and
5 excessive wear can result. Further disadvantages with
6 frame-tensioned screens include weight, cost and size,
7 and the premature failure of an existing pneumatic
8 frame-clamping system requires the replacement of both
9 the screen and the clamping system. Further, there is
10 no universal screen available that can readily be
11 adapted or fitted to the various models of vibratory
12 unit.

13

14 According to the present invention there is provided
15 apparatus for attaching filter means to a frame, the
16 apparatus comprising a bladder member adapted to change
17 the conformation of its cross-section upon ingress of
18 fluid into the bladder member, and a groove adapted to
19 receive the bladder member, wherein a conformational
20 change in the bladder member moves the filter means
21 into the groove, thereby securing the filter means to
22 the frame.

23

24 The groove may be disposed on the frame or on the
25 apparatus.

26

27 The conformational change of the bladder member
28 preferably tensions the filter means in addition to
29 securing it to the frame. The apparatus or the frame
30 may be provided with additional clamping means to clamp
31 the filter means to the frame.

32

33 The clamping means may likewise be disposed on the
34 frame or on the apparatus.

35

36 The filter means may comprise one or more layers of

1 filter material, not all of which need be tensioned by
2 the tensioning means.

3
4 Preferably, the apparatus is configured such that at
5 least part of the filter means is disposed between the
6 bladder member and the groove, and change in the
7 conformation of the bladder member forces the filter
8 means into the groove thereby tensioning at least said
9 part of the filter means.

10
11 The bladder member may be provided by any member which
12 may change conformation upon ingress of fluid into it,
13 for example, to adopt a conformation having a generally
14 circular cross-section. Bladder members having
15 resilient and non-resilient walls are within the scope
16 of the invention. The bladder member may be closed or
17 open ended, for example a conduit through which the
18 fluid flows or a tube having a closed end.

19
20 The bladder member can operate to apply force across
21 the filter means. The direction of applied force can
22 be lateral, and/or longitudinal. The bladder member(s)
23 can be provided at one or more lateral edges of the
24 filter means, eg, at opposing lateral edges, so as to
25 apply force laterally across the filter means.

26
27 The apparatus may additionally comprise tensioning
28 means in the form of other devices such as pneumatic or
29 hydraulic rams or gas springs etc, disposed to tension
30 the filter member in a longitudinal direction. A
31 preferred variant of longitudinal tensioning means
32 comprises a bladder member disposed between the
33 attachment points of the filter means to the frame (eg
34 between two support frames), so that it can inflate and
35 extend at least part of the apparatus along its
36 longitudinal axis.

1 The filter means can incorporate resilient areas (eg
2 around the edges).

3

4 The filter means is preferably stretched longitudinally
5 before being stretched laterally.

6

7 While further modifications and improvements may be
8 made without departing from the scope of this
9 invention, the following description is of one or more
10 examples of the invention, with reference to the
11 accompanying drawings, in which:

12

13 Fig. 1 shows a plan view of a single mesh screen;
14 Fig. 2 shows an end view of clamping apparatus
15 according to the invention;

16 Fig. 3 shows an end view of further clamping
17 apparatus;

18 Fig. 4 shows two cradles of a shale shaker adapted
19 with an embodiment of the invention;

20 Fig. 5 shows a hose support groove of the Fig. 2
21 and 3 apparatus;

22 Fig. 6 shows a plan view (a) and a side view (b)
23 of a support frame of the Fig. 4 cradle; and

24 Fig. 7 shows a piston assembly holding a cradle in
25 place in the Fig 2 and 3 apparatus.

26

27 Referring now to the drawings, Fig. 1 shows a screen 1
28 for use in the apparatus shown in Figs. 3, 4 and 5.
29 The screen 1 comprises a woven stainless steel mesh 2,
30 although the mesh can be of other material, for example
31 plastics or other metals, and can be single, double or
32 another multiple of meshes. The mesh 2 has attached at
33 each longitudinal side a hose assembly 4 comprising a
34 sleeve 5 surrounding a hose 6 and having a dowel 7 at
35 its peripheral edge. The sleeve 5 is divided into an
36 upper layer 5a and a lower layer 5b. The hose 6 is

1 preferably of the lay flat type assuming a flattened
2 shape when not inflated. The hose 6 and dowel 7 are
3 preferably of thermoplastic material.

4

5 The transverse edge of the mesh 2 can be provided with
6 (optionally thermoplastic) hooks 8 which are bonded or
7 otherwise attached to the mesh 2. —

8

9 The screen 1 can be fitted to existing cradles 10, 20,
10 40 by providing hose support grooves 15 (Fig. 5) at the
11 longitudinal edges of the cradles 10, 20, 40. The hose
12 support grooves 15 each comprise moulded (eg PVC)
13 strips (see Fig. 4) having a shoulder 16 and a groove
14 17 for receiving the hose 6. When fixed in place at
15 the longitudinal edges of the cradles 10, 20, the
16 shoulder 16 defines a pair of wells 18a and b of
17 approximately equal width and depth.

18

19 A wedge wire frame 25 spans the breadth of the cradle
20 10, 20 between the two grooves 15, and supports the
21 mesh 2. The screen 1 is stretched over the breadth of
22 the assembled cradle and grooves and the dowels 7 are
23 inserted into the outermost wells 18a on the support
24 grooves 15. A clip 11 having a general C-shaped cross
25 section is then pushed over the shoulder 16 and the two
26 arms of the clip 11 extend into the wells 18a and 18b,
27 pushing the dowel 7 into well 18a, and the sleeve at 5b
28 in to the well 18b, thereby applying tension to the
29 mesh 2 across the breadth of the cradle 10, 20 in the
30 direction of arrow B in Figs. 2, 3. The clip 11 is
31 fixed at a suitable height by lips 12 or guide rails 22
32 so that the mesh 2 is subject to some tension, and the
33 hoses 6 are located in the grooves 17 of the hose
34 support grooves 50.

35

36 When the screen 1 is suitably positioned in the cradle

1 10, 20, and the hoses 6 are deflated, the two faces of
2 the sleeve 5a, b, will be lying substantially close to
3 one another, and the hose 6 will be substantially flat.
4 Further, there will be a space between the deflated
5 hose 6 and the face of the groove 17. Upon inflation
6 of the hose, faces 5a and b of the sleeve 5 will be
7 pushed apart by the laterally expanding hose 6; face 5a
8 will be pushed up against the lip 12 (or guide rail 22)
9 whereas face 5b will be pushed down into the groove 17.
10 The diameter of the hose 6 and/or the depth of the
11 groove 17 can be chosen to press the faces 5a, b
12 against the respective boundaries to a greater or
13 lesser extent, depending on the tension required.
14

15 Therefore, by inflation of the hose, the screen 1 is
16 stretched laterally across the breadth of the cradle
17 10, 20 in the direction of arrow 13 in Fig. 2, 3, and
18 at the same time is clamped in position by the same
19 force of the hose 6 against the faces 5a, b and groove
20 17 and lip 12/guide rail 22.

21

22 The screen 1 can be fitted to existing models of square
23 or rectangular vibratory units in conventional shale
24 shakers. For example, the existing clamping on
25 conventional shale shakers can be removed and guide
26 rails/lips and hose support grooves 15 can be fitted.
27 Indeed, one embodiment of the invention comprises a
28 conversion kit for conventional shale shakers
29 comprising one or more screens and means to attach the
30 screen to the shaker and to tension the screen across
31 the shaker, for example by means of the wells 18,
32 groove 17 and lip 12/guide rail 22. All of the
33 materials can be formed with plastics or metal,
34 preferably ferrous metals such as stainless steel. The
35 conversion kit may also comprise screen cradles to fit
36 the shale shakers.

1 An optional variation to the support frame 25 comprises
2 a frame 26 made up of two sections a and b (Fig. 6).
3 26a and b are movable in the direction of arrow A in
4 Fig. 6 which, in use, is parallel to the long axis of
5 the hose assembly 4, and perpendicular to arrow B in
6 Figs. 2 and 3. Arrow A is also marked in Fig. 1.

7
8 Hooks 8 on the screen 1 can be attached to nose plates
9 27 at the transverse edges of the frame 26 so that the
10 screen 1 is fixed at each end. Sections 26a and b are
11 split at 28 and have two spaced-apart arms 28 a, b
12 extending perpendicularly from the plane of the frame
13 26 and below its upper surface. The split 28 can be at
14 any point on the frame 26, but is preferably at one
15 end; notably, in the embodiment of Fig. 4 at opposing
16 ends of each frame 26. One of the arms 28a located on
17 26a has a leg which extends towards arm 28b, thereby
18 defining a channel between arms 28a and b and the leg.
19 A hose 3 is located in the channel between arms 28a and
20 b, and upon inflation, it forces the arms a and b
21 apart, thereby sliding portions 26a and b further apart
22 in the direction indicated by arrow A, and tensioning
23 the screen 1 attached to the frame 26 in the same
24 direction. The hose 3 can optionally be inflated from
25 the same air supply as hose 5, or can be inflated from
26 an entirely separate air supply.

27
28 The cradles can be flat 40f or wedge-shaped 40w, and a
29 multiple of the same or different cradles 40f/w can be
30 used in tandem, according to the design of shale shaker
31 required.

32
33 Each cradle 10, 20, 40 can be fitted with an air line
34 running longitudinally along it, and each hose assembly
35 4 can be provided with a stem connector in
36 communication with the air line, to which the hoses 6

1 are connected at cartridges 6a on end blocks 6b.

2

3 The or each rear cradle 10, 20, 40 can be provided with
4 connectors for the ring main, and the rear ends of both
5 front cradles can have co-operating stem connectors
6 such that when the cradles are fully inserted in to the
7 vibratory units basket, the front and rear-ring main
8 air lines are linked, and by connecting the left hand
9 front cradle inner air line to the right hand inner air
10 line, the ring main is primed for connection to the
11 main air supply.

12

13 The screen 1 can be loaded onto a vibratory unit by
14 removing the cradles 10, 20, 40, and securing the
15 screen 1 over the support frame 25/26 with hooks 8
16 attached to nose plates 27. The frame 25/26 and screen
17 1 are then located on the cradle 10, 20, 40 the hose
18 assembly 4 located in the hose support grooves 15 and
19 anchor dowels 7 located in wells 18 as previously
20 described.

21

22 Inflation of the hose 4 then clamps the screen 1 and
23 tensions it in direction B as previously described.
24 The screen 1 is preferably tensioned in direction A
25 before being tensioned in direction B, but this can be
26 reversed, or tension can be applied in both directions
27 at the same time.

28

29 Disconnection of the apparatus air supply unclamps the
30 screen and relieves the tension to allow withdrawal of
31 the cradles from the basket and removal of the screen
32 from the support frame 26.

33

34 In the embodiment shown in Fig. 2, a transverse
35 framework 22 is used to support the frame
36 26, and in turn is supported by the existing camber

1 bars 23 of the cradle 10.

2

3 The screen 1 is preferably earthed to a ferrous metal
4 portion of the cradle 10, 20, 40 so as to earth any
5 static electricity generated through operation of the
6 vibrator unit.

7

8 The hose support grooves 15 can optionally include an
9 air supply line 30 in a recess 31 closed by a keeper
10 plate 32. The supply line 30 connects the main air
11 supply to a stem connector in the rear end of the
12 groove 17 for connection to the cartridge 6a in the end
13 block 6b of the hose 6.

14

15 In use, the dowels 7 and sheaths 5b are pressed into
16 wells 18 by the clip 11 as previously described, and
17 the stem connectors are pressed into the hose end
18 blocks 6b. The screen 1 is then stretched over the
19 support frame 26 and the transverse hooks 8 are hooked
20 over the nose plates 27 of the frame 26.

21

22 In the Fig. 2 embodiment, the hoses 6 are expanded to
23 press the faces of the sleeve 5 into the groove 17
24 and against the lip 12. These are held pressed against
25 the peripheries of the groove and lip so as to keep the
26 mesh 2 in tension in direction B on top of the support
27 frame 26.

28

29 The hose 3 can be inflated at the same time and from
30 the same air supply as that which inflates the hoses 6,
31 or alternatively, can be inflated from a different air
32 supply source at a different time. In any event,
33 inflation of the hose pushes apart the arms 28a, b and
34 applies tension in the direction of arrow A to the
35 screen 1.

36

1 Fig. 7 shows an optional piston assembly 45 attached to
2 a cradle transverse bar 40t which extends, in the
3 assembled apparatus, in the direction of arrow B at the
4 rear end of the cradle 40. The cradle 40 abuts against
5 the basket cross-member 50, again extending in the
6 direction B. The piston assembly 45 has a piston 45p
7 with a bevelled end which abuts against the corner of
8 the basket cross-member 50, and when the piston 45p is
9 extended, it exerts a force on the cradle 40 in the
10 direction of arrow C, thereby securing the cradle 40 in
11 the basket 50 and allowing for a variance in the
12 dimensions of the basket 50 or cradle 40.

13

14 Embodiments of the invention have the advantages that
15 the tensioning and clamping force can optionally be
16 provided from the same air supply source. The screen 2
17 can also be retro-fitted to existing vibratory
18 apparatus, optionally with the provision of hose
19 support grooves 15.

20

21 The screen of the invention can be provided on a
22 lighter and less bulky construction, and can
23 additionally be rolled up for storage and transport.
24 This is particularly beneficial for use on oil rigs,
25 where weight and space is at a premium. The lower
26 weight achievable by embodiments of the invention
27 is also an advantage in view of the vibratory forces
28 which will be applied to the apparatus when in use,
29 thereby reducing the load on the vibratory apparatus.
30 The screen 1 can be manufactured from synthetic
31 plastics materials to provide rust free embodiments.
32 In addition, the hose tensioning assembly of the screen
33 2 can absorb air pressure and incompatibilities from
34 differing screen mesh sizes.

1 **Claims:**

2

3 1 Apparatus for attaching filter means to a frame, the
4 apparatus comprising a bladder member adapted to change
5 the conformation of its cross-section upon ingress of
6 fluid into the bladder member, and a groove adapted to
7 receive the bladder member, wherein a conformational
8 change in the bladder member moves the filter means
9 into the groove, thereby securing the filter means to
10 the frame.

11

12 2 Apparatus as claimed in claim 1, wherein the groove
13 is disposed on the frame.

14

15 3 Apparatus as claimed in claim 1, wherein the groove
16 is disposed on the apparatus.

17

18 4 Apparatus as claimed in any preceding claim, wherein
19 the conformational change of the bladder member
20 tensions the filter means in addition to securing it to
21 the frame.

22

23 5 Apparatus as claimed in any preceding claim,
24 including additional clamping means to clamp the filter
25 means to the frame.

26

27 6 Apparatus as claimed in claim 5, wherein the
28 clamping means is disposed on the frame.

29

30 7 Apparatus as claimed in claim 5, wherein the
31 clamping means is disposed on the apparatus.

32

33 8 Apparatus as claimed in any preceding claim, wherein
34 the filter means comprises a single layer of filter
35 material.

36

- 1 9 Apparatus as claimed in any one of claims 1-7,
2 wherein the filter means comprises a two or more layers
3 of filter material.
- 4
- 5 10 Apparatus as claimed claim 9, wherein not all of
6 the two or more layers of filter material are tensioned
7 by the apparatus.
- 8
- 9 11 Apparatus as claimed in any one of the preceding
10 claims, wherein the apparatus is configured such that
11 at least part of the filter means is disposed between
12 the bladder member and the groove, and change in the
13 conformation of the bladder member forces the filter
14 means into the groove thereby tensioning at least said
15 part of the filter means.
- 16
- 17 12 Apparatus as claimed in any preceding claim,
18 wherein the bladder member has a generally circular
19 cross-section.
- 20
- 21 13 Apparatus as claimed in any preceding claim,
22 wherein the bladder member includes resilient walls.
- 23
- 24 14 Apparatus as claimed in any preceding claim,
25 wherein the bladder member includes non-resilient
26 walls.
- 27
- 28 15 Apparatus as claimed in any preceding claim,
29 wherein the bladder member comprises a tube having a
30 closed end.
- 31
- 32 16 Apparatus as claimed in any one of claims 1-14,
33 wherein the bladder member comprises a conduit in a
34 ring circuit.
- 35
- 36 17 Apparatus as claimed in any preceding claim,

1 wherein the bladder member(s) are provided at one or
2 more lateral edges of the filter means.

3

4 18 Apparatus as claimed in any preceding claim,
5 including tensioning means disposed to tension the
6 filter member in a longitudinal direction.

7

8 19 Apparatus as claimed in claim 18, wherein the
9 tensioning means comprises a bladder member disposed
10 between the attachment points of the filter means to
11 the frame.

12

13 20 Apparatus as claimed in claim 18, wherein the
14 tensioning means comprise pneumatic or hydraulic rams
15 or gas springs.

16

17 21 Apparatus as claimed in any preceding claim, wherein
18 the filter means incorporates resilient areas.

19

20 22 Apparatus as claimed in any one of claims 18-21,
21 wherein the filter means is stretched longitudinally
22 before being stretched laterally.

23

24 23 Apparatus as claimed in claim 18 or 19, wherein the
25 bladder members are inflated from the same source as
26 the additional tensioning means.

27

28 24 Apparatus as claimed in claim 18 or 19, wherein the
29 bladder members are inflated from a different source
30 than the additional tensioning means.

31

32

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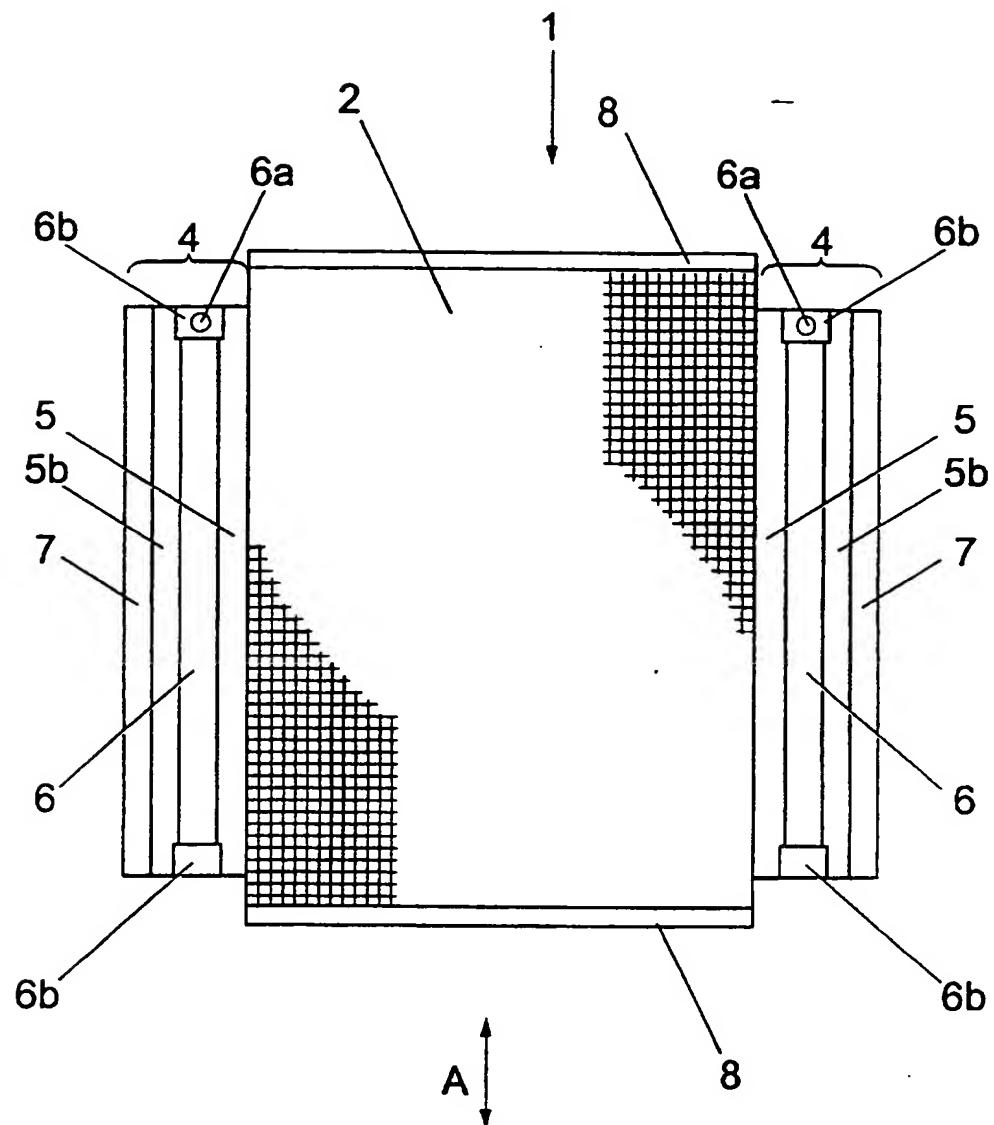


Fig. 1

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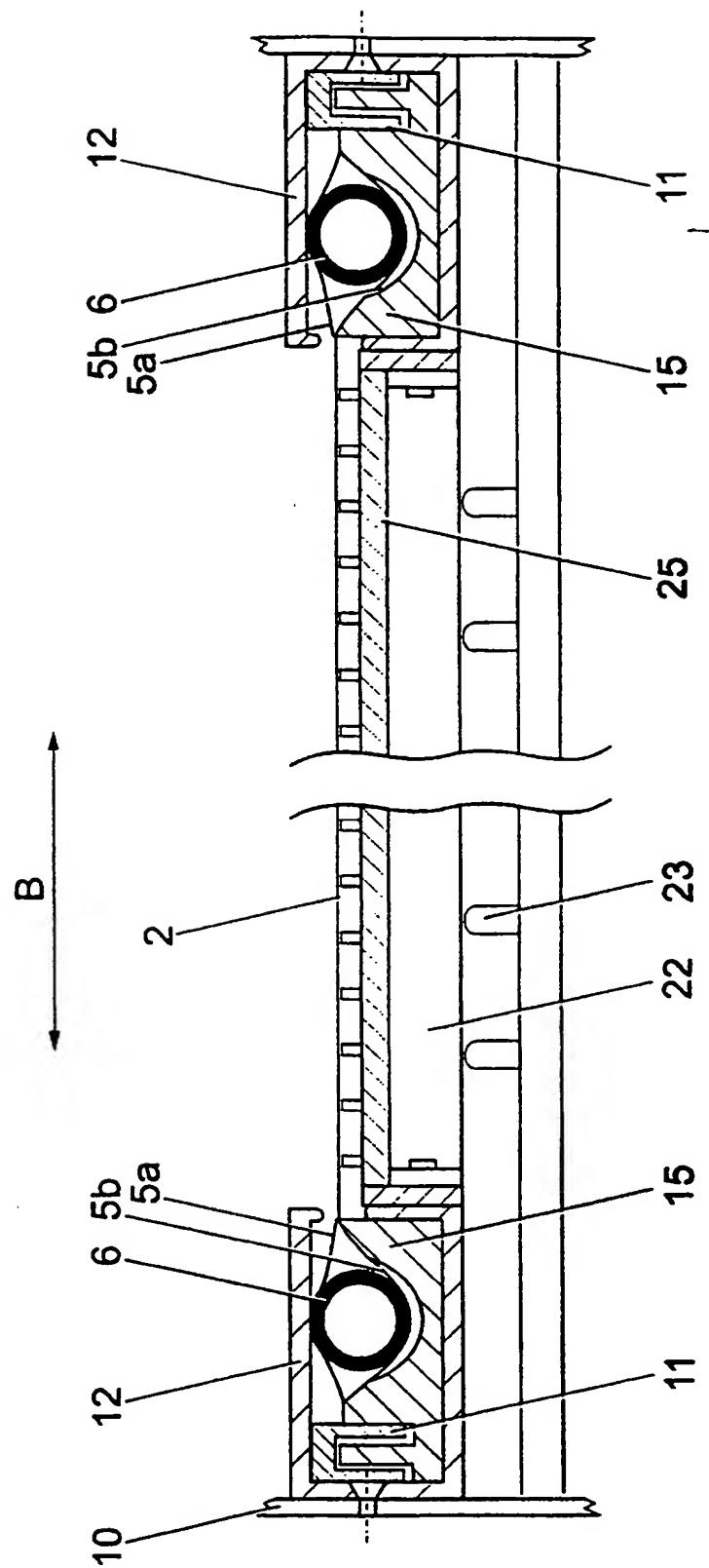


Fig. 2

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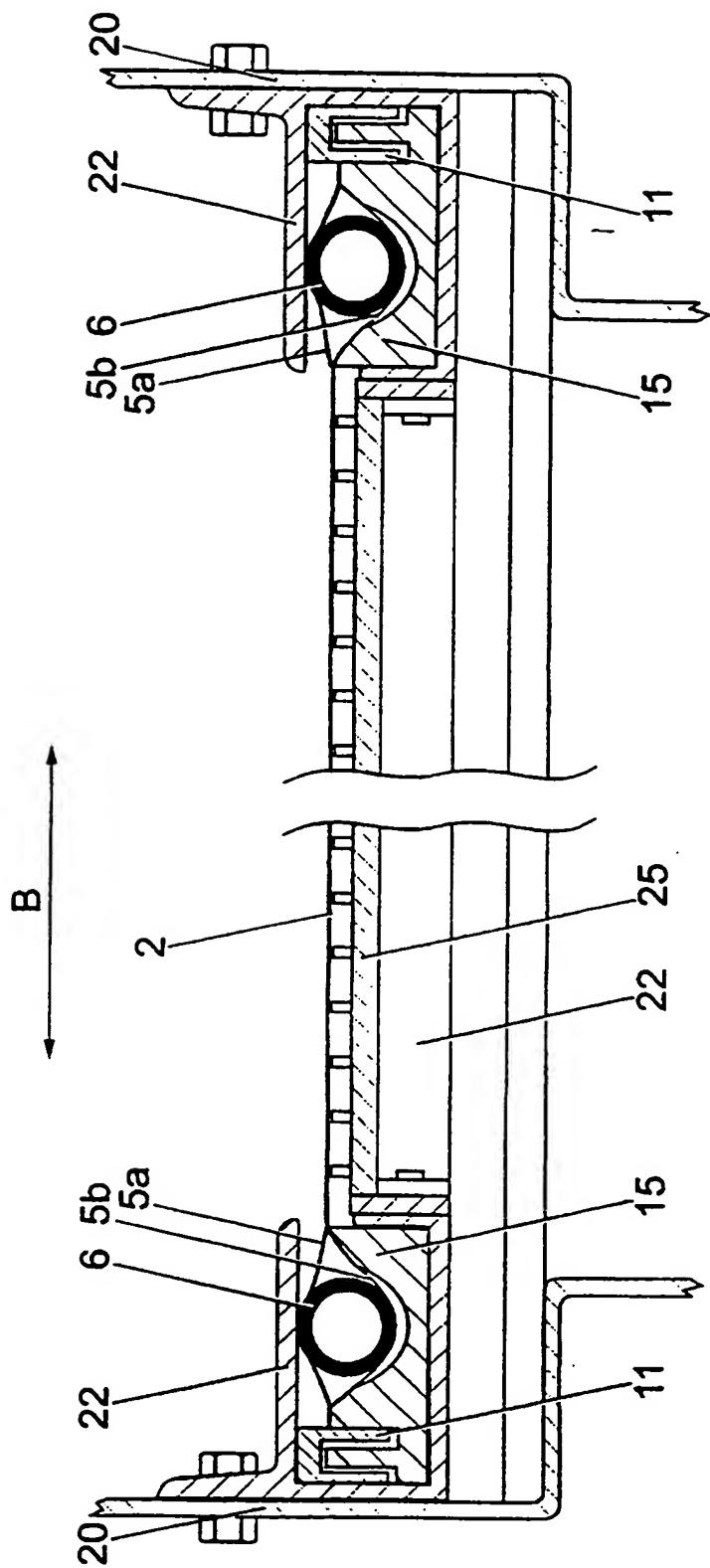


Fig. 3

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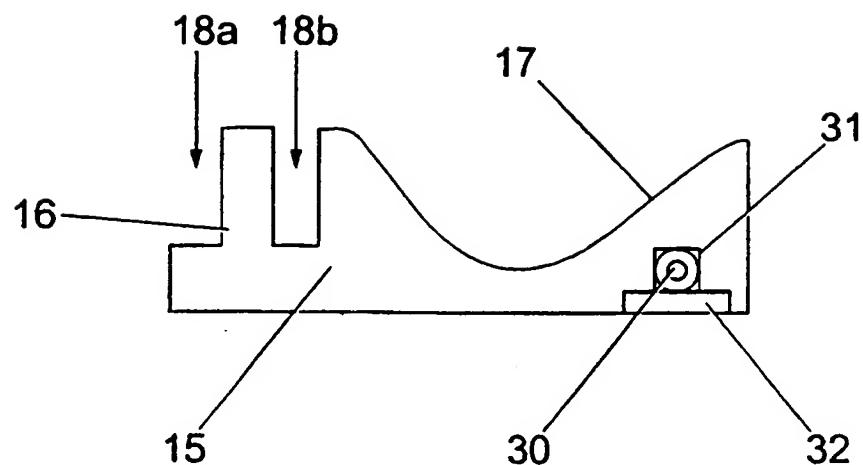


Fig. 5

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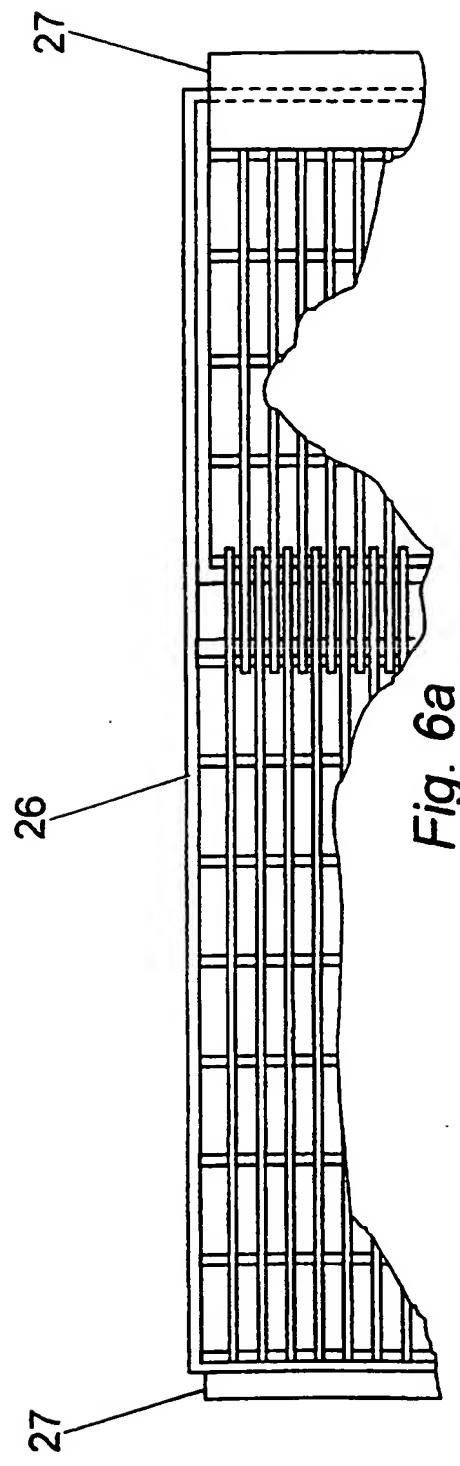


Fig. 6a

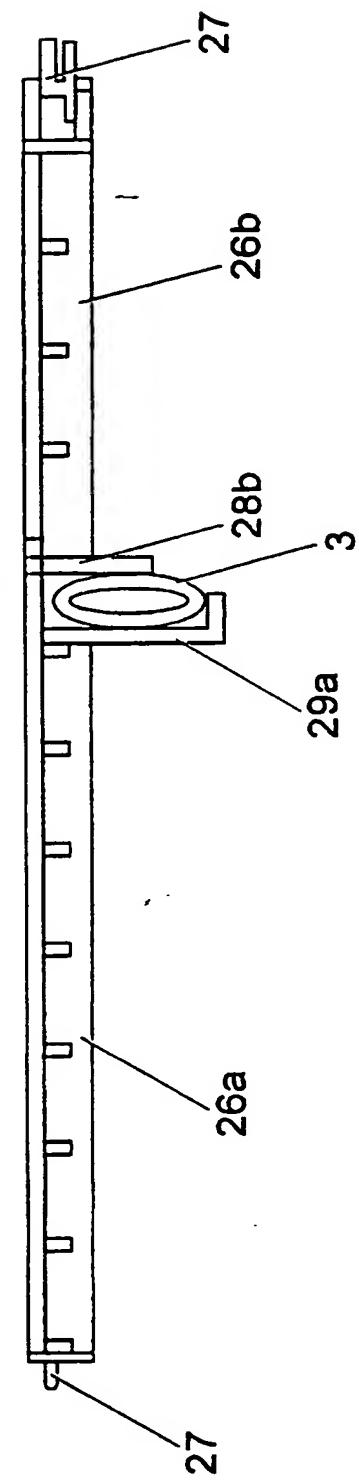


Fig. 6b

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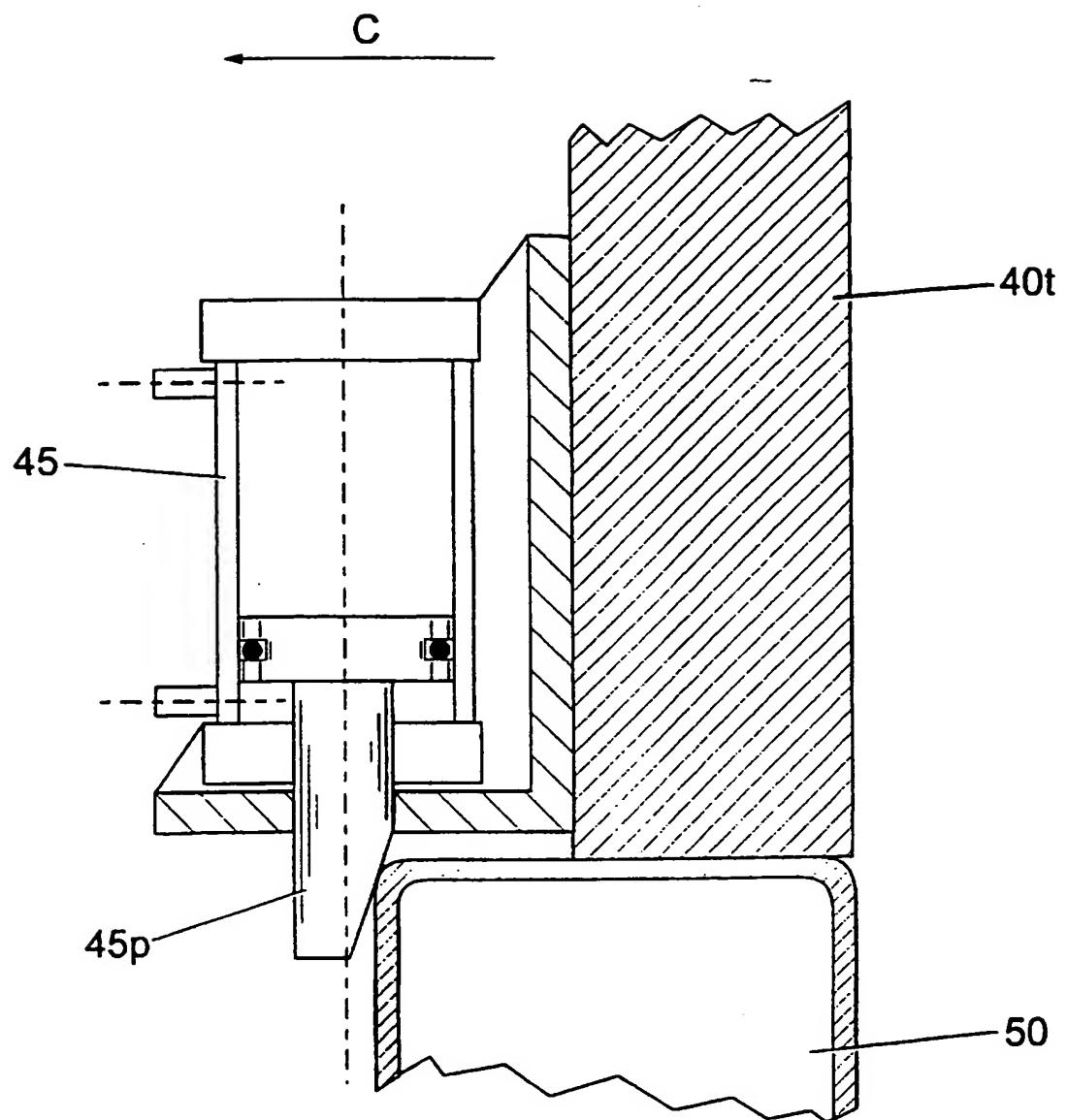


Fig. 7

INTERNATIONAL SEARCH REPORT

Internatinal Application No

PCT/GB 97/01607

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B07B1/48

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 B07B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 2 564 338 A (KANZAKI PAPAER MANUFACTURING CO. LTD.) 22 November 1985 see page 2, line 26 - page 3, paragraph 1 see page 3, line 28 - page 7, line 6; figures -----	1,2,4-8, 11,12
A	US 4 846 352 A (BAILEY) 11 July 1989 see column 3, line 1 - column 4, line 26; figures -----	1,11,13, 17,18



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Patent family members are listed in annex.

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Tel. (+31-70) 340-2040, Tx. 31 651 epo nl
Fax: (+31-70) 340-3016

Authorized officer

Plaka, T

INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
FR 2564338 A	22-11-85	DE	3517592 A	21-11-85
US 4846352 A	11-07-89	AU	583127 B	20-04-89
		AU	5856786 A	18-12-86
		CA	1304718 A	07-07-92
		EP	0218315 A	15-04-87
		GB	2176425 A,B	31-12-86